South West Water Authority

RESOURCE PLANNING

SCIENTIFIC SERVICES

Classification

INTERNAL

BIOLOGICAL SURVEY OF THE RIVER TEIGN AND TRIBUTARIES, WITH REFERENCE TO THE EFFECT OF BALL CLAY DISCHARGES.

Prepared by: M.D. MOLD

For the Attention of:

Reference No.

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D. BATTERSBY
Director of Resource Planning

MARCH 1979

SOUTH WEST WATER AUTHORITY

DIRECTORATE OF RESOURCE PLANNING

SCIENTIFIC SERVICES

Biological survey of the River Teign and tributaries, with reference to the effect of Ball Clay discharges, October 1978.

PREPARED BY: M.D. Mold

TO: Chief Scientific Officer

DATE: March 1979.

SUMMARY

A survey of the macroinvertebrate riffle fauna in the Ball Clay mining area of the Bovey Basin, following a period of low rainfall, indicated that the River Bovey and the River Teign between Chudleigh and Teign Bridge, Newton Abbot were of good quality. Further downstream, the R. Teign and the lower reaches of the Ugbrooke Stream were identified as being of doubtful quality with the discharge from ECC Broadway continuing to give cause for concern.

RECOMMENDATIONS

1. The polluted condition of the Ugbrooke Stream and the R.Teign below Lower Marsh Quarry, even after a peridd of low rainfall, should be noted.

2. The effect of increased solids loadings on the invertebrate fauna should be assessed in a future survey following a protracted period of heavy rain.

CIRCULATION LIST (For final Report)

DIRECTOR OF RESOURCE PLANNING

Chief Scientific Officer

Principal Scientific Officer - SS

" " " - QC

Senior Scientific Officer -- RQ

" " " - Rivers

Water Quality Officer - Div 3

Assistant Inspector - Div 3 West

DIRECTOR OF FISHERIES AND RECREATION

Fisheries and Recreation Officer - Div 3

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1. INTRODUCTION

A survey of the benthic macroinvertebrate communities of riffle zones in the Bovey Basin was carried out on 24th October, 1978, in response to a request from S.S.O - River Quality for assessment of the effects of the South Devon ball clay mining industry prior to the on-set of winter rainfall and the expected commensurate increase in suspended solids loading to the rivers.

2. METHODS

A full invertebrate survey was undertaken, involving the collection of benthic organisms by the standard 2-minute kick method and processing of the material in the laboratory. Nine sites were chosen on the main River Teign with two each on the R.Bovey and Ugbrooke Stream. Their position in relation to known discharges is shown in Fig 1. The notation for discharges is the same as that used for chemical surveys of the area and is outlined in Appendix 1.

3. RESULTS

3.1. Previous Surveys

3.1.1. A previous on-site survey of the catchment in August 1977 concluded that all sites on the R.Teign and R.Bovey supported communities indicative of clean water conditions (DOE Class A) but that marginal deterioration occurred downstream of Chudleigh Knighton, Bellamarsh Leat (SD7) and Preston (SD9). No deterioration in quality was seen below the confluence with the Ugbrooke Stream or below discharge SD15.

3.1.2. In contrast, reductions in quality were attributed to the discharges at Ringslade on the Blatchford Brook and at Broadway on the Ugbrooke Stream. The poor quality of the Ugbrooke Stream was again confirmed by laboratory processed samples in May 1978 (see para. 3.2.7.).

3.2. Present Survey

3.2.1. In the present survey no samples were taken on the Blatchford Brook due to the lack of representative riffle sites and the destruction of previously used sites by rechannelling work.

3.2.2. The species lists recorded for each site are shown in Appendix 2. The data have been condensed to three biotic indices viz: Total Taxa, Extended Trent Biotic Index and Chandler Score. These are shown in Table 1 and Fig. 2.

3.2.3. All sites on the R.Bovey and on the R.Teign, with the exception of B11 (d/s SD15), supported diverse communities comprising several species from most commonly occurring taxa, indicative of good water quality. The decline in quality between site B4 (Chudleigh) and site B5 (S.E. of Chudleigh Knighton), seen as a reduction in taxa from 37 to 28 and in Chandler Score from 2,206 to 1,496, was possibly due to the intermittent discharge from the storm sewage overflow located at SX 852774.

3.2.4. Site B11, below SD15, had a substrate with considerable grey clay deposition, supporting a community of only 20 taxa and an abundance of organisms which was less than that recorded at all other sites. Silt-loving chironomid larvae and oligochaete worms comprised 32% of

the community, resulting in a Chandler Score of 1,069, indicative of doubtful water quality.

3.2.5. All sites other that B13, downstream of the Broadway discharge (SD13), supported considerable growths of diatoms and filamentous algae suggesting that during the preceeding period turbidity had not limited light penetration to such an extent as to significantly affect photosynthesis.

3.2.6. Both sites on the Ugbrooke Stream had much clay deposition in the interstices of the bed and supported more restricted communities than were found at upstream sites on the Teign and Bovey. The effect of the Broadway discharge was particularly discernable, reducing the Chandler Score from 1,144 at Abbrook Bridge (B12) to 814 downstream of the discharge. This figure represents a condition bordering on unacceptable quality according to the guidelines laid down for routine use in the S.W.W.A area (see Fig. 2C)

3.2.7. The conditions recorded at B12 and B13 in the present survey showed marginal improvement over those seen in May 1978 when Chandler Scores of 888 and 664 were recorded for the same sites.

4. DISCUSSION

4.1. The biological conditions of the Rivers Teign and Bovey continue to reflect good water quality. Despite the pitfalls inherent in comparing on-site data with that obtained from fully processed samples, it would appear that after the period of low summer flow in 1978 there was no evidence for the deterioration in quality previously seen in August 1977 below Chudleigh Knighton, Bellamarsh Leat or Preston.

4.2. In contrast to the conclusions of the 1977 survey the present data indicate a deterioration in quality below the discharge from the ECC Lower Marsh Quarry (SD15). This may also represent a cumulative effect of clay from upstream discharges settling out in this uniform reach of river.

4.3. The condition of the Ugbrooke Stream between Abbrook Bridge and the confluence with the R.Teign continues to give cause for concern, with the effect of the discharge from Broadway Quarry and Mine (ECC) producing an unacceptable deterioration in water quality.

4.4. Because this survey was carried out after a period of low solids loading the biological results presented here may be expected to reflect conditions at the better end of the spectrum and serve as a control for those occurring after a period of greater rainfall and increased solids loading. With this in mind, selected sites in the present survey have been written into a proposed routine monitoring programme for the whole authority area (SSR/BB/78/8).

5. CONCLUSIONS

5.1. The R.Bovey and R.Teign between Chudleigh and Teign Bridge, Newton Abbot were shown to be of good quality. The present survey revealed an improvement in water quality below the discharges at Chudleigh Knighton, Bellamarsh Leat and Preston, in contrast to the deterioration previously recorded in August 1977.

5.2. A deterioration in quality of the lower R.Teign was recorded below the discharge from ECC Lower Marsh Quarry , confirming the results of the chemical survey for the same period.

5.3. The condition of the lower reaches of the Ugbrooke Stream falls into the doubtful category of water quality, with the ECC Broadway discharge continuing to have the largest single polluting influence in the Ball Clay mining area.

6. RECOMMENDATIONS

6.1. The polluted condition of the Ugbrooke Stream and the R. Teign below Lower Marsh Quarry, even after a period of low rainfall, should be noted.

6.2. The effect of increased solids loading on the invertebrate river fauna should be assessed in a future survey following a protracted period of heavy rain.

7. REFERENCE

1. Ball Clay Study, May 1978 - January 1979. D. Litten Assistant Inspector Div 3W. Report to the Ball Clay Technical Committee, March 1979.

2. Biological Survey: R.Teign and tributaries with reference to the discharge of ball clay wastes (19 & 22.8.77). M.D. Mold Internal Report of the Biology Section , S.W.W.A.

3. A biological survey of selected rivers of the South West Water Authority, Spring 1978. M.D. Mold & P.M. Williams . SWWA Scientific Services Report SSR/BB/78/7, November 1978.

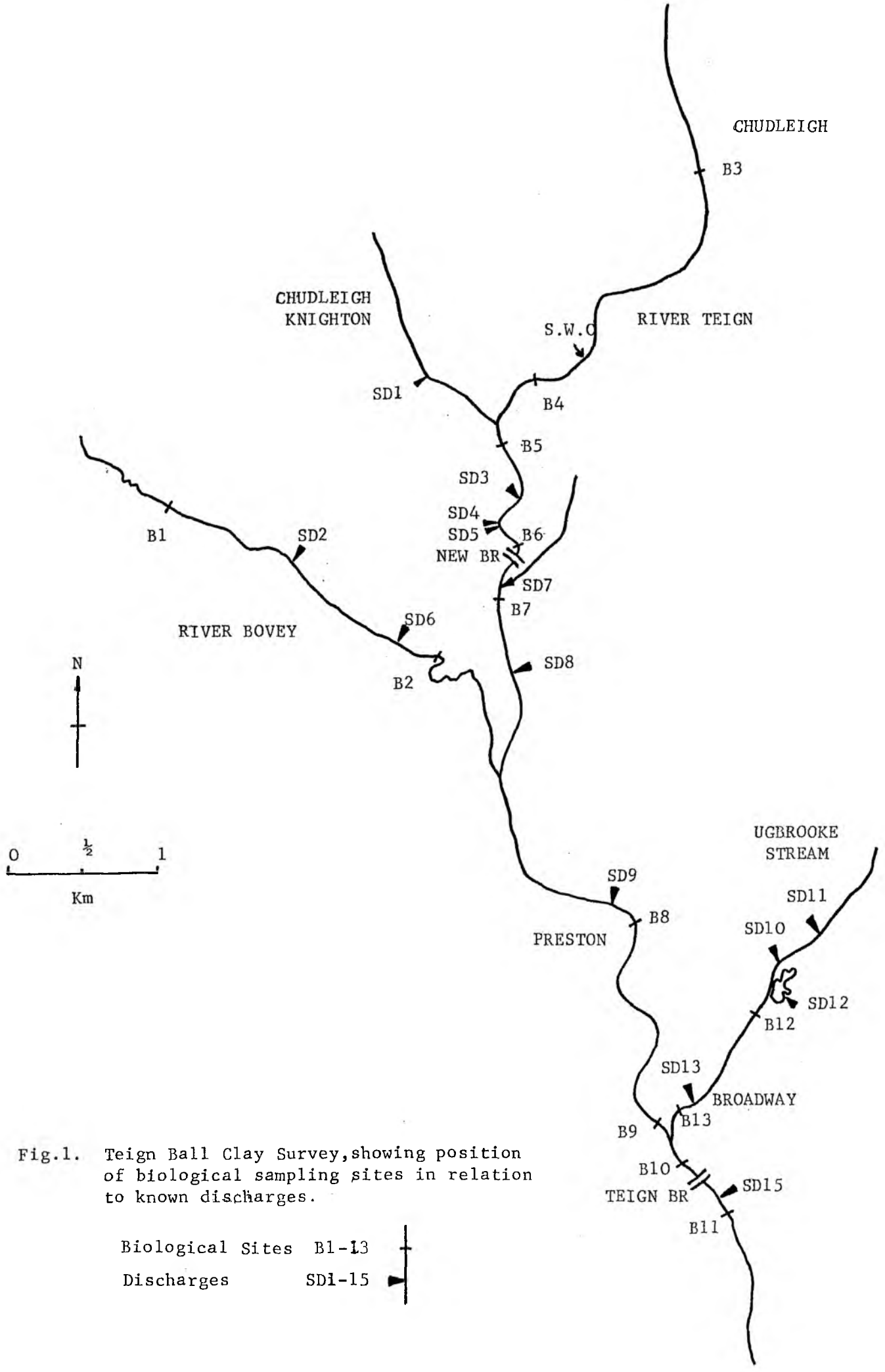

Fig.1. Teign Ball Clay Survey, showing position of biological sampling sites in relation to known discharges.

Biological Sites B1-13

Discharges SD1-15

Table 1. Summary of Biological Sampling Sites and Macroinvertebrate Community Parameters, River Teign Ball Clay Survey . 24 October 1978.

No.	Site Name	NGR	Nearest chem. site	Total no. of Taxa	Extended Trent Biotic Index	Chandler Score
	River Bovey					
B 1	Little Bovey	SX832768	R4	29	11	1,706
B 2	Twinyeo Farm	SX845760	R6	31	11	1,854
	River Teign					
B 3	Chudleigh	SX857785	R1	37	12	2,206
B 4	u/s Chudleigh Knighton	SX848773	-	28	11	1,496
B 5	d/s Chudleigh Knighton	SX848770	-	30	11	1,818
B 6	New Bridge	SX849765	R9	31	11	1,736
B 7	d/s Bellamarsh Leat (SD8)	SX848763	R10	30	11	1,631
B 8	Preston	SX85557470	R12	35	12	2,039
B 9	u/s Ugbrooke confluence	SX857736	-	29	11	1,630
B 10	Teign Bridge	SX858735	R19	32	11	1,768
B 11	d/s SD15	SX860733	-	20	10	1,069
	Ugbrooke Stream					
B 12	Abbrook Bridge	SX862742	R16	25	10	1,144
B 13	Broadway (d/s SD13)	SX858737	R18	21	8	814

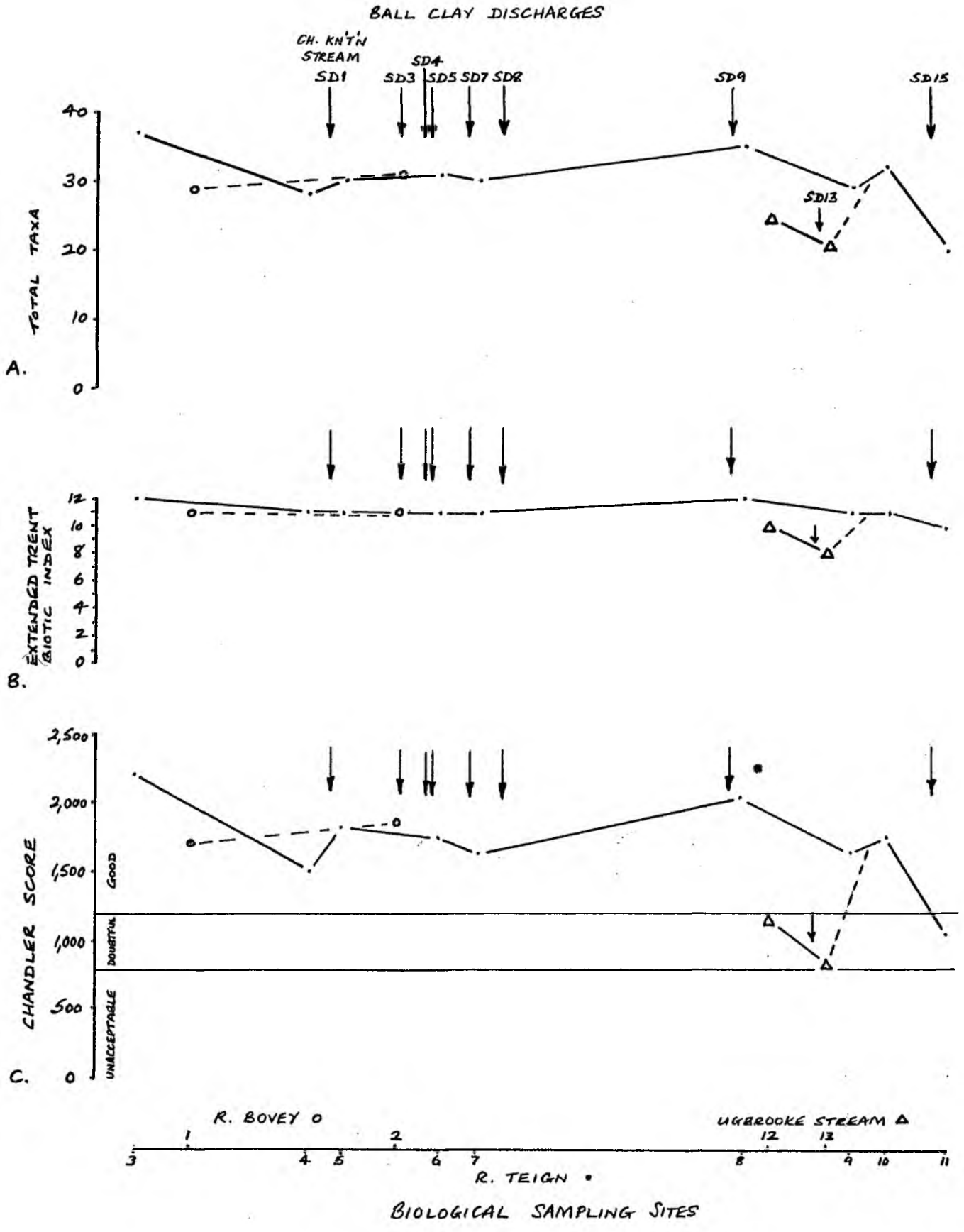

FIG. 2. BALL CLAY SURVEY: R. TEIGN & TRIBS., BIOLOGICAL INDICES, 24 OCTOBER 1978.

Appendix 1 BALL CLAY DISCHARGES SOUTH DEVON 1978

No	NGR (SX)	Name	Co	Description
SD 1	8454 7737	Chudleigh Knighton Heath (Teign)	WBB	Quarry pumps to two lagoons in parallel to ditch, to trib to R. Teign sample point as 'V' notch to be installed 2m upstream confluence of ditch with stream.
SD 2	8396 7639	Chudleigh Knighton Heath (Bovey)	WBB	Quarry pumps to culvert through quarry surround then to ditches across heathland including some surface water to discharge immediately upstream Jaws Bridge on R.Bovey LHB sample point at 'V' notch to be installed 10m upstream confluence of ditch with river.
SD 3	8490 7673	Claylane Quarry	WBB	Quarry pumps to 3 lagoon settlement area then to secondary lagoon then with yard drainage along ditch to R. Teign RHB, sample point a 'V' notch to be installed 7m upstream confluence of ditch with river. High level overflow from 3 lagoon system discharges via ditches through point SD5 .
SD 4	8479 7656	Newbridge Quarry (Teign Pump)	ECC	Alternative to point SD5. Quarry pumps to lagoon for settlement, secondary pumps discharge to R.Teign RHB at piped outlet approximately 200m upstream of New Bridge sample point at tapping to be made on discharge pipe.
SD 5	8480 7655	Newbridge Quarry (Teign Ditch)	ECC	Alternative to point SD4. Quarry pumps direct to ditch discharging to R.Teign RHB immediately downstream of outlet SD4. Sample point at 'V' notch to be installed 5m upstream of public footpath crossing.

No	NGR (SX)	Name	Co	Description
SD 6	8435 7607	Newbridge Quarry (Bovey)	ECC	Small catchment settling pond pumped to ditches discharging to R.Bovey LHB approximately 15m downstream of access bridge to spoil tip, sample point at 'V' notch to be installed 5m upstream confluence of ditch with river.
SD 7	8480 7624	No 11 mine and Horsemills Copse	WBB	Discharges to old leat discharging to R.Teign LHB approximately 180m downstream of New Bridge, will incl: some surface drainage, sample point at 'V' notch to be installed immediately prior to discharge.
SD 8	8489 7595	Horsemills Pond	WBB	Serving Rixey Park Quarry, pumps to pond with overflow piped to short ditch to R.Teign LHB, sample point at 'V' notch to be installed 6m upstream of confluence of ditch with river.
SD 9	8552 7472	Southacre and Longmarsh Quarries	WBB	Quarries pump to long ditch system discharging to R. Teign LHB at Mortimers Farm, Preston, sample point at 'V' notch to be installed 20m upstream confluence of ditch with river.
SD 10	8620 7449	No 4 Mine and John Acres Lane Quarry	WBB	Discharges to Junipark pond for settlement, sample point at overflow from pond approximately 30m prior to confluence with Ugbrooke Stream, 'V' notch to be installed.
SD 11	8632 7465	White Open Quarry	WBB	Quarry pumps to long ditch system discharging to Ugbrooke Stream approximately 3m downstream of track bridge from access by Abbrook House, sample point at 'V' notch to be installed in ditch 5m upstream of confluence with stream.
SD 12	8632 7430	Abbrook Works, Clay Body Preparation Plant	WBB	Process effluent discharges via short ditch to Abbrook pond, sample point at 'V' notch to be installed in ditch prior to discharge to pond.

No	NGR (SX)	Name	Co	Description
SD 13	8579 7380	Broadway Quarry and Mine	ECC	Quarry pumps to 3 lagoon settlement on RH bank of Ugbrooke Stream approximately 110m upstream from confluence of Ugbrooke Stream and R.Teign, sample point at 'V' notch to be installed at combined outlet from lagoons. (Alum used in settlement) Mine pumps to pond within quarry, second pumps to lagoons as above - SD 13.
SD 15	8595 7340	Lower Marsh Quarry	ECC	Quarry pumps direct to piped discharge to R. Teign LHB approximately 50m downstream of Teign Bridge, sample point to be tapping off rising pump main.
SD 16	8618 7301	Pinsents Quarry	WBB	Quarry pumps to lagoon near top of quarry, second stage pumps to piped discharge to R.Teign RHB. Sample point at pump tapping.
SD 17	8591 7245	Newton Abbot Clays (Process effluent)	WBB	Effluent to primary lagoons within works, then under railway and canal to secondary pond then overflow to tidal Whitelake, sample point at 'V' notch to be installed at outlet from secondary pond-liable to tidal flooding at high tides.
SD 18	8470 7380	Stover Quarry	ECC	Quarry pumps to small pond at edge of quarry then secondary pumps to long ditch discharging to Butlands stream approximately 190m upstream of road crossing, Teigngrace, sample point at 'V' notch to be installed just prior to discharge to stream.
SD 19		Mainbow/Ringslade	ECC	New lagoon system under construction. 'V' notch to be incorporated at final discharge to Blatchford brook.
SD 20	8580 7238	No 10 Mine (3")	WBB	Mine pumps to 3" pipe outfall at edge of mine yard, sample point at pipe discharge to tidal Whitelake.

No	NGR (SX)	Name	Co	Description
SD 21	8580 7238	No 10 Mine (6")	WBB	Mine pumps to 6" pipe outfall at edge of mine yard, sample point at pipe discharge to tidal Whitelake.
SD 22	8582 7230	No 10 Mine (ditch)	WBB	Mine pumps to ditch to outfall SW corner of yard, sample at 'V' notch.

Appendix 2. Ball Clay Survey. Macroinvertebrate species data, (numbers quoted per 2 minute kick-sample)- 24 October 1978.

RIVER	BOVEY		R. TEIGN									UGBROOKE STREAM	
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
SITE	Little Bovey	Twinyeo Fm.	Chudleigh	U/S Ch. Knighton.	D/S Ch. Knighton	U/S New Br.	D/S Bella-marsh Leat	D/S Preston Discharge	U/S Ugbrooke Confl.	D/S Ugbrooke Confl.	D/S Teign Br. Discharge.	Abbrook Br.	U/S Teign Confl.
TAXON													
PLECOPTERA													
Perlodes microcephala	1		1	1	2	10	14	5	9	4			
Isoperla grammatica	2	1	2	2				1					
Chloroperla torrentium	1												
Protonemura meyeri	176	3	1	3	34	23	19	97	6	3	1		
Amphinemura sulsicollis		5	1										
Leuctra hippopus			11	3	4	6	7	1		2			
EPHEMEROPTERA													
Baetis rhodani	50	53	10	53	76	51	18	48	24	21		32	11
B. scambus			2	5		2		1	1	1			
B. muticus				2									
Rhithrogena semicolorata	135	134			84	52	14	89	43	91	4	2	
Ecdyonurus dispar	15	13	7	1	11	15	9	10	9	80	1	2	2
E. venosus			1					7		9	1		
Heptagenia sp.									1				
Caenis sp.	9	11					1	1	2				
Ephemerella vulgata	2					6							
Ephemera danica												4	

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
TRICHOPTERA													
Sericostoma personatum	1	3	48	4	34		8	7	13	3	2	3	
Lepidostoma hirtum	1	2	10		3					1			
Lasocephala basalis			11		2	1		15		2			
Brachycentrus subnubilis		7	8			6	1	7			2		
Glossosoma boltoni	28	64		23	73	16	1	16	23	33			
Glossoma (juv.)				540		536	49	168	115	111	5		
Agapetus fuscipes		16	9	1									
Potamophylax sp. gp.			5										
Athripsodes cinereus			2										
Ceraclea sp. (juv.)									1				
Mystacides sp. (juv.)			2										
Leptoceridae indet.					1								
Rhyacophila dorsalis	15	4		5			2	1	2	5		13	6
Hydropsyche siltalai	78	9		2	5		15	6	3			5	22
H. pellucidula	49	20	25	3	25	37	34	15	11	7		11	152
H. angustipennis												4	8
Hydropsyche sp. (juv.)				1	16	18	13	17	5	3	2	1	5
Polycentropus flavomaculatus			2										
P. kingi					1								
Plectrocnemia geniculata			2										
COLEOPTERA													
Elmis aenea (1)		9	12	4	8	37	11	124	14	30	5	47	25
" " (a)	7	4	2		13	18	7	65	6	12	8	6	6
Limnius volckmari (1)	54	20	37	5	29	58	15	78	24	33	27	15	24
" " (a)	5	20		7	12	20	23	34	12	11	3	2	1
Oulimnius tuberculatus (1)	11	3	6					1			4	2	5
" " (a)			1		4	2	1	24	9	5	6		
Esolus parallelipipedus (1)			66	5	123	57							
" " (a)							22	28	51	80	82		

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
COLEOPTERA (cont)													
Hydraena (a)	1	9		6	11	14	3	16	15	17			1
Gyrinus sp. (1)	27	24	7	16	29	31	15	20	20	40	7		1
Dytiscidae (1)			2										
Platambus sp. (a)			1										
DIPTERA													
Chironomidae	36	82	36	97	170	238	71	166	135	78	41	35	11
Simulium sp.	6	41	7	18	28	40	29	88	25	16		1	2
Atherix ibis	3	12	5	2	28	,9	8	13	7	11	10		1
Clinocera sp.	2		4	3	18	18	7	18	1	1	1		
Limnophora sp.	3	1			1							1	
Dicranota sp.			1		6	2	1	1	1	2			
Tipula sp.			1										
Ceratopogonidae					1		1						
Tabanidae						1				1			
Pericoma sp.			1									1	
Dixa sp.			2										
CRUSTACEA													
Asellus aquaticus			5										
A. meridianus			1	1	1			1	1			6	1
Gammarus pulex										2		85	30
Ostracoda												1	
MOLLUSCA													
Ancylus fluviatilis	7	26	11	2	5	84	3	149	5	27	32	30	
Potamopyrgus jenkinsi	1	22			1		1					43	450
Lymnea pereger			19	1	3	2	1	1		1	1		
Pisidium sp.			1		1							3	
Sphaerium sp.								2					

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
HIRUDINEA													
Erpobdella octoculata		2	1										
Batracobdella			1									2	
Glossiphonia complanata												3	6
Piscicola geometra		1											
OLIGOCHAETA													
Tubificidae/Naididae	9	19	107	15	16	46	6	36	6	25	56	53	8
Eiseniella tetraedra										1			
LEPIDOPTERA													
Nymphula sp.	1												
ARACHNIDA													
Hydracarina		4	40	1	5	4	7	18	1	1	1		
PLATYHELMINTHES													
Polycelis sp.													1
COLLEMBOLA													
Indet sp.													1
Total Individuals	736	646	537	758	892	1476	437	1395	601	770	302	413	870
Total Taxa	29	31	37	28	30	31	30	35	29	32	20	25	21
Extended Trent Index	11	11	12	11	11	11	11	12	11	11	10	10	8
Chandler Score	1706	1854	2206	1496	1818	1736	1631	2037	1630	1768	1069	1444	814